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FINAL
Confirmation Sampling and Analysis Plan for Installation Restoration Program Site ST35 Ordnance Testing Laboratory Oil Leak

AF CENTER FOR ENVIRONMENTAL EXCELLENCE

Air Force Plant PJKS
Colorado

Prepared For

Air Force Center for Environmental Excellence
Brooks Air Force Base

and

Headquarters Aeronautical Systems Center
Environmental Management Division (ASC/EMR)
Wright-Patterson AFB, Ohio

September 1996

PARSONS
ENGINEERING SCIENCE, INC.

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FINAL

CONFIRMATION SAMPLING AND ANALYSIS PLAN FOR INSTALLATION RESTORATION PROGRAM SITE ST35 ORDNANCE TESTING LABORATORY OIL LEAK AIR FORCE PLANT PJKS, COLORADO

Prepared for:

Air Force Center for Environmental Excellence
Brooks AFB, Texas
and

Headquarters Aeronautical Systems Center
Environmental Management Division (ASC/EMR)
Wright-Patterson AFB, Ohio

September 1996

Prepared by:
Parsons Engineering Science, Inc.
1700 Broadway, Suite 900

Denver, Colorado 80290

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SECTION 1

INTRODUCTION

This confirmation soil sampling and analysis plan (SAP) has been prepared by Parsons Engineering Science, Inc. (Parsons ES), formerly Engineering-Science, Inc. (ES), for submittal to the US Air Force Center for Environmental Excellence (AFCEE), Brooks Air Force Base (AFB), Texas, and Headquarters Aeronautical Systems Center, Environmental Management Division (ASC/EMR), Wright-Patterson AFB, Ohio. The SAP is intended to guide soil sampling at Installation Restoration Program (IRP) Site ST35 at Air Force Plant (AFP) PJKS, Colorado. Site ST35 is the location of a release of heating oil from a former underground storage tank (UST).

In 1992, Site ST35 was selected as a pilot test site for the AFCEE-sponsored Bioventing Pilot Test Initiative Project. The Bioventing Initiative is an ongoing project involving more than 100 *in situ* bioventing pilot tests at 46 Air Force installations nationwide. These tests were designed to collect data on the effectiveness of bioventing for the remediation of vadose zone soils contaminated with fuel hydrocarbons (e.g., JP-4 jet fuel, diesel fuel, gasoline, and heating oil).

The 1-year bioventing pilot test, completed in 1994, was performed at IRP Site ST35, located at the Ordnance Testing Laboratory (OTL), designated Operable Unit 6 (OU6) of the National Priorities List (NPL) AFP PJKS site. Site ST35 is the former location of a heating oil UST. The purpose of the pilot test was to evaluate the effectiveness of bioventing in remediating unsaturated soils contaminated with petroleum hydrocarbons thought to have resulted from heating oil released from the former UST. The UST was removed in November 1985 (Engineering-Science, Inc. (ES), 1992). Based on the results of the extended bioventing test, *in situ* bioventing appears to have reduced petroleum hydrocarbon contamination in site soils sufficiently to meet Colorado Department of Labor and Employment (CDOLE), Oil Inspection Section requirements for closure of the OTL UST site. This SAP presents a plan for confirmation soil sampling to document the effectiveness of remediation of hydrocarbon contaminated soils at the OTL UST site.

This SAP consists of ten sections, including this introduction. Section 2 includes site description, history, and summaries of previous investigations and remediation activities. Section 3 summarizes site closure requirements. A detailed SAP is presented in Section 4. Analytical results will be presented in a confirmation soil sampling report as described in Section 5. Section 6 is a waste management plan for investigation-derived waste generated during drilling and sampling activities. Section 7 lists AFP PJKS support requirements and Section 8 gives the proposed project

schedule. Points of contact are provided in Section 9 and the references cited are provided in Section 10.

The objective of the confirmatory soil sampling is to support an Air Force no-further-response-action-planned (NFRAP) recommendation for the soils contaminated by heating oil in the immediate vicinity of the former UST, pursuant to closure of IRP Site ST35. The proposed closure sampling described in Section 4 is specific to the medium (vadose zone soils) targeted by the bioventing system in the vicinity of the former UST. The confirmatory soil sampling effort is being performed as part of the AFCEE Extended Bioventing project. In addition, an ongoing supplemental remedial investigation/feasibility study (SRI/FS) which considers Site ST35, as well as, site groundwater (which is included in OU5 of the NPL site), is being conducted through a separate contract being performed by Parsons ES (1996) for AFCEE and ASC/EMR.

SECTION 2

SITE DESCRIPTION

AFP PJKS is located on 464 acres of land in the foothills of the Colorado Front Range, northwest of the town of Waterton, and 20 miles southwest of the city of Denver. AFP PJKS is surrounded by approximately 4,700 acres of land owned by the Lockheed Martin Company (formerly Martin-Marietta), the plant operator. From 1956 until the present, AFP PJKS activities have consisted primarily of missile assembly, engine testing, and research and development.

2.1 SITE LOCATION AND HISTORY

The OTL area is located in the southeastern portion of AFP PJKS and has been designated as OU6. Figure 2.1 is a layout of the OTL area. Three potential source areas for contamination within OU6 have been identified and investigated under the Air Force IRP. These sites are Site ST35, the oil leak from the former heating oil UST (the subject of this plan); Site OT09, the open detonation/open burning pit; and Site SS52, a cavitette, and associated piping and leachfield. The former UST that contained number 2 heating fuel was located along the east side of Building T-26 (Figure 2.1). In 1985, a leak was detected in the UST. The volume of the leak was estimated to be between 600 and 1,000 gallons, based on tank inventory measurements (ES, 1992).

Discovery of the release prompted removal of the tank and investigations of the areal extent of soil and groundwater contamination. The tank, which was buried 3 feet below ground surface (bgs) and surrounded by an open-bottomed concrete vault, was removed in November 1985 by Martin Marietta. A rupture in the tank measuring approximately 0.25-inch in diameter was observed at the southern end of the tank bottom during removal (ES, 1992).

2.2 TOPOGRAPHY, HYDROLOGY, GEOLOGY AND HYDROGEOLOGY

2.2.1 Topography and Surface Hydrology

The topography of AFP PJKS is primarily a central valley separating linear ridges to the east and rugged irregular mountains to the west. The plant is located west of the Dakota Sandstone hogback, which is a north-northwest/south-southeast trending exposure of uplifted sandstone that separates the foothills topography to the west from the plains to the east. AFP PJKS is dissected by the drainages of East and West Forks of Brush Creek. The East Fork of Brush Creek contains water year round, and the West Fork of Brush Creek is an intermittent stream. At its closest point, the West Fork

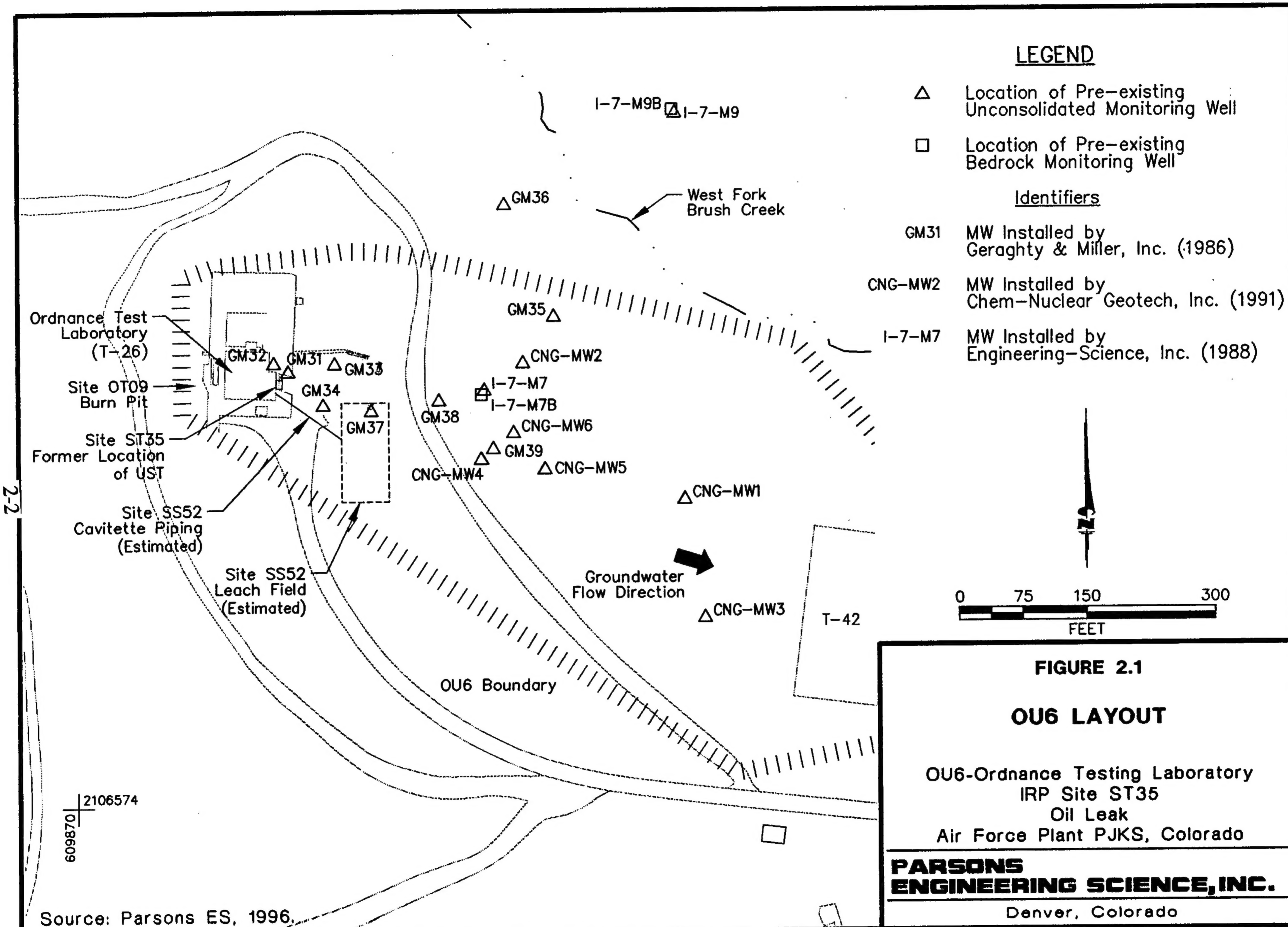

FIGURE 2.1

OU6 LAYOUT

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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of Brush Creek passes to the northwest of the OTL at a distance of more than 400 feet (Figure 2.1).

2.2.2 Geology

The geology beneath the OTL is characterized by fill material and Quaternary alluvial deposits overlying a thin, weathered, sandstone bedrock zone of the Fountain Formation. Fill and alluvium thicknesses range from approximately 0 to 39 feet beneath OU6. The alluvium is generally poorly sorted, but the basal section contains locally discontinuous, moderately well-sorted sands. The weathered bedrock is usually less than 10 feet thick, and forms a more permeable veneer overlying well-cemented Fountain Formation sandstones. The alluvium thickens over a buried paleochannel incised into the bedrock surface, which appears to trend eastward from Building T-26.

2.2.3 Hydrogeology

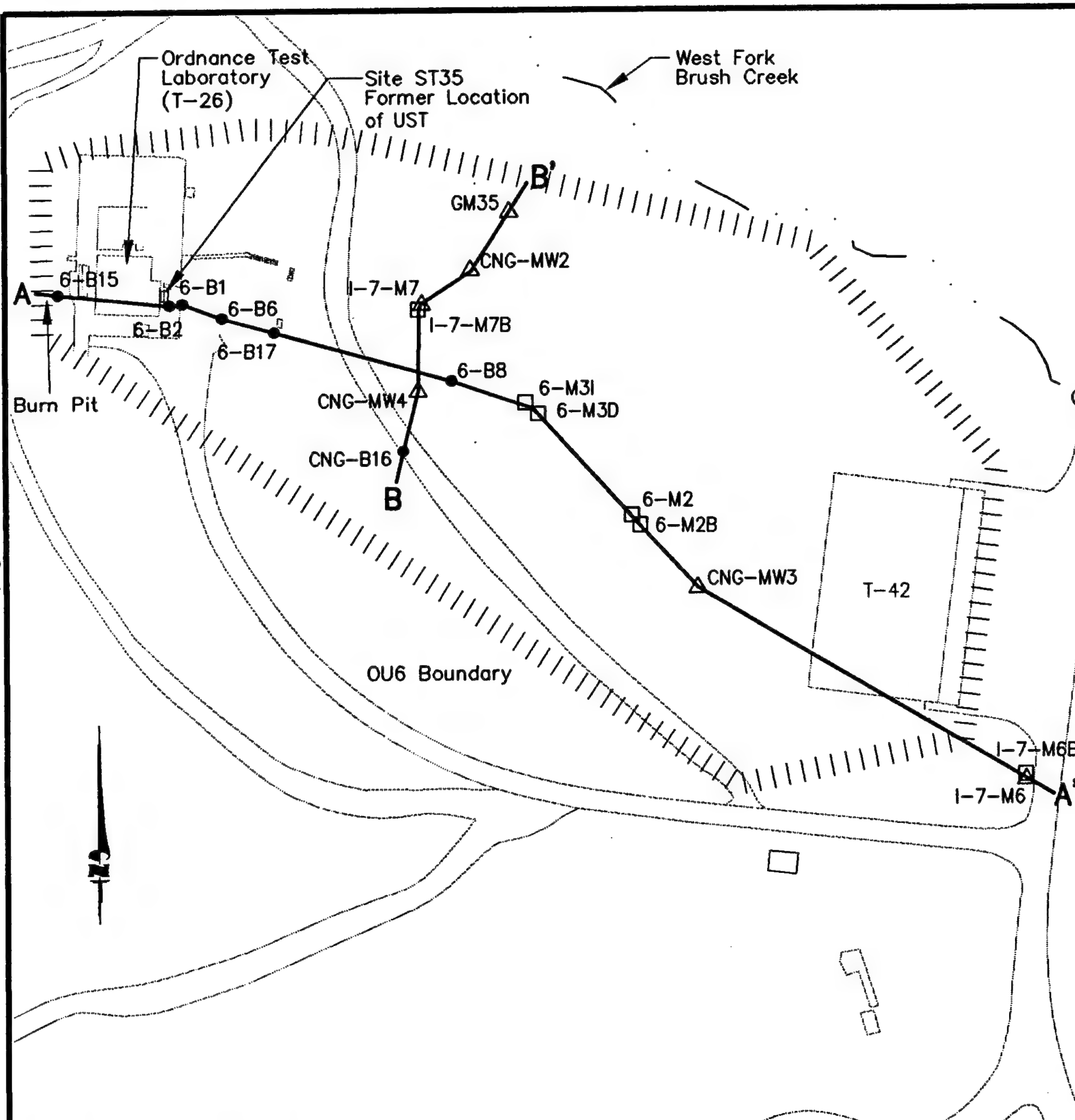
The water table beneath the OTL is generally coincident with the top of the weathered sandstone Fountain bedrock at a depth of approximately 20 to 25 feet bgs. The weathered bedrock zone is generally less than 10 feet thick, and is more permeable than the underlying, unweathered Fountain Formation (Geraghty & Miller, Inc., 1986). Groundwater flow within the alluvium/weathered bedrock is southeasterly toward West Fork of Brush Creek. Limited hydraulic conductivity data for the area indicate alluvial transmissivities in the range of 50 to 160 gallons per day per foot (gpd/ft), and a groundwater flow velocity of approximately 1 to 3 feet per day (ft/day). The southeasterly trending paleochannel described above appears to be a preferential migration pathway for alluvial groundwater.

The upper Fountain Formation hydrogeologic system, which underlies the alluvium and weathered bedrock, appears to be largely unconfined, and forms a single upper aquifer with the overlying alluvium. At greater depths, groundwater in the bedrock aquifer occurs under both confined and partially-confined conditions. The locations of east-west and north-south hydrogeologic cross-sections for OU6 are shown on Figure 2.2 and the cross-sections are provided at Figures 2.3 and 2.4.

2.3 PREVIOUS INVESTIGATIONS

2.3.1 1985 Geraghty & Miller, Inc. Investigations

Following removal of the heating oil UST in 1985, Geraghty & Miller, Inc. (1986) collected soil samples and installed nine groundwater monitoring wells in the OTL area. Findings indicated residual hydrocarbons in the soil, and downgradient migration of a free-phase product plume of heating oil on the groundwater to a distance approximately 115 feet east of the former UST (Figure 2.5). On the basis of the Geraghty & Miller 1985 field investigation, heating oil contamination was suspected to have migrated approximately 250 feet east from the source area through unconsolidated deposits.



LEGEND

△ Location of Pre-existing Unconsolidated Monitoring Well

□ Location of Pre-existing Bedrock Monitoring Well

● Location of Borehole

Identifiers

GM31 MW Installed by Geraghty & Miller, Inc. (1986)

CNG-MW2 MW Installed by Chem-Nuclear Geotech, Inc. (1991)

I-7-M7 MW Installed by Engineering-Science, Inc. (1988)

6-B6 Borehole Installed by Engineering-Science, Inc. (1992)

A—A' Cross-Section Locations (See Figures 2.3 and 2.4)

0 75 150 300
FEET

FIGURE 2.2

LOCATION OF HYDROGEOLOGIC PROFILES A-A' AND B-B'

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Source: Parsons ES, 1996.

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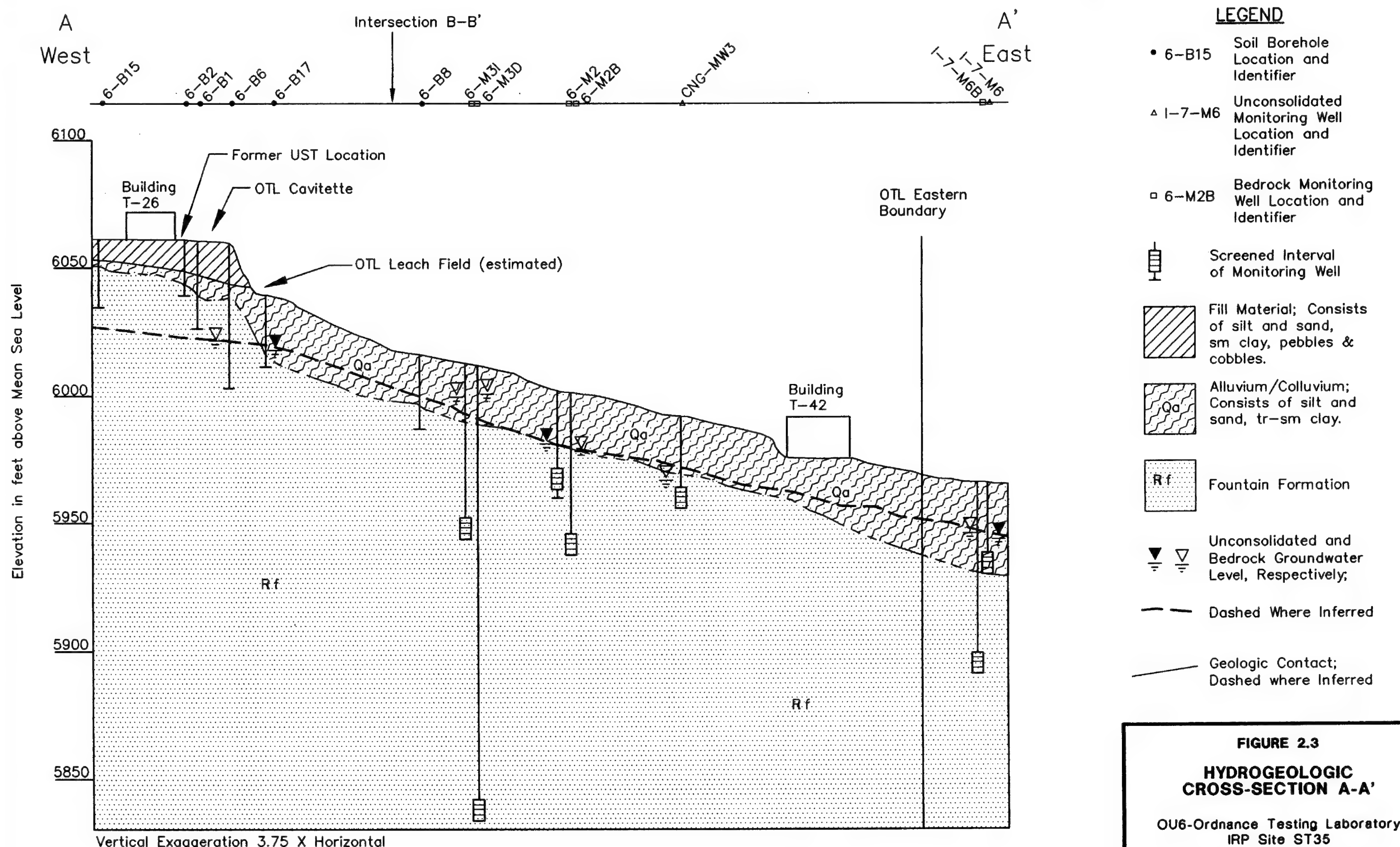

FIGURE 2.3

HYDROGEOLOGIC CROSS-SECTION A-A'

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IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

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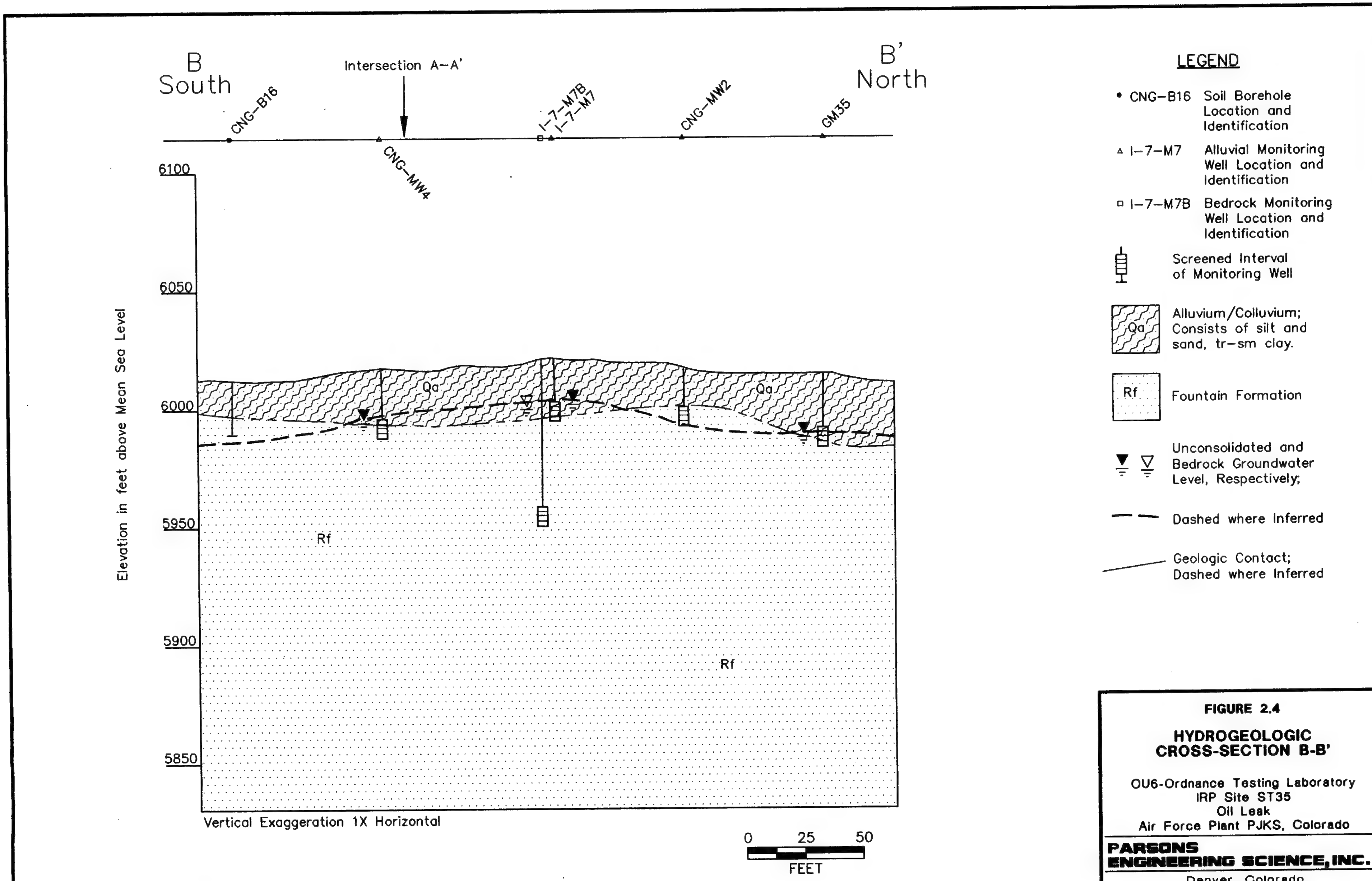

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FIGURE 2.4

HYDROGEOLOGIC CROSS-SECTION B-B'

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IRP Site ST35
Oil Leak
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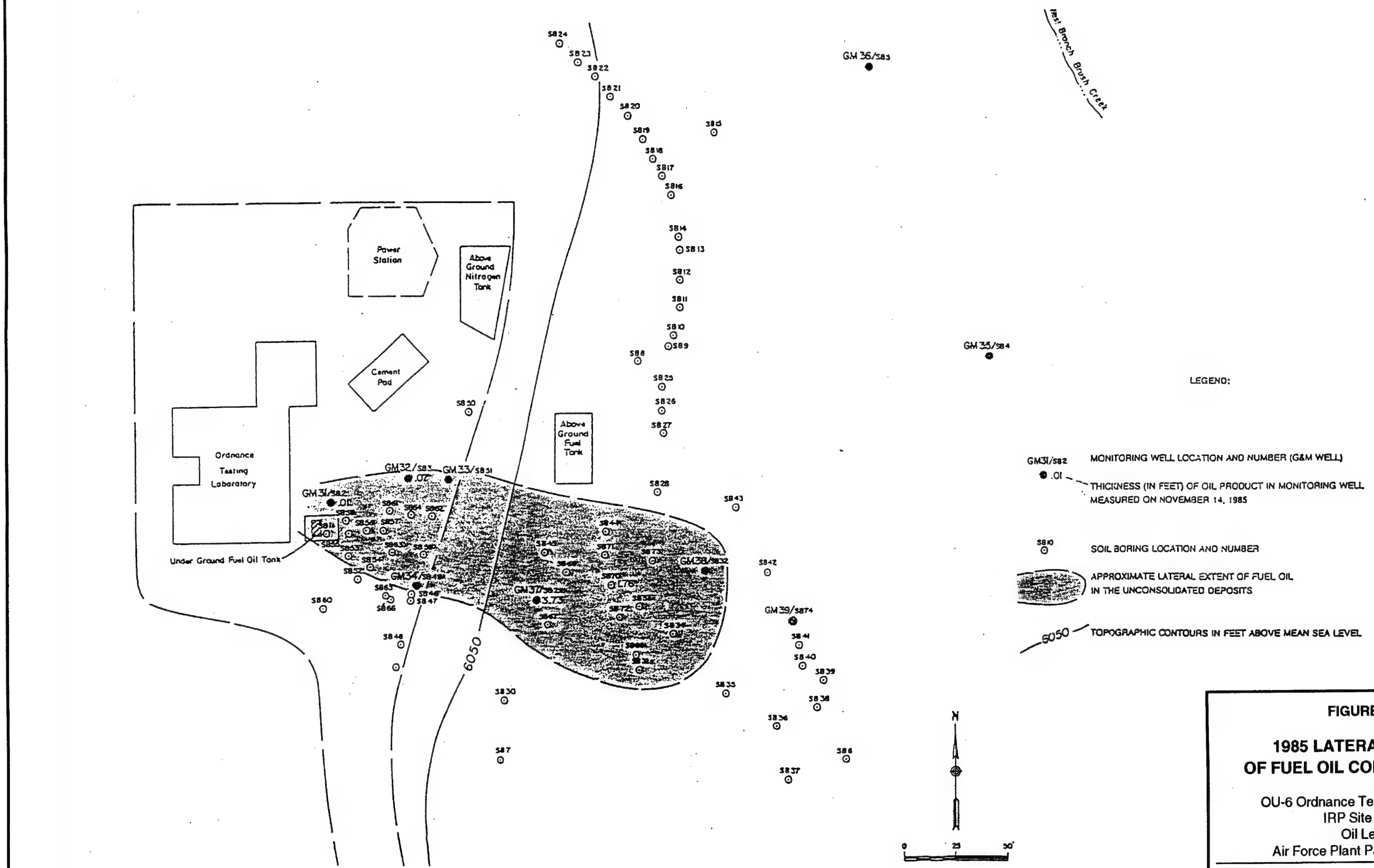


FIGURE 2.5

1985 LATERAL EXTENT OF FUEL OIL CONTAMINATION

OU-6 Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Source: Geraghty & Miller, Inc., 1986.

2.3.2 1987 Engineering-Science, Inc. Investigations

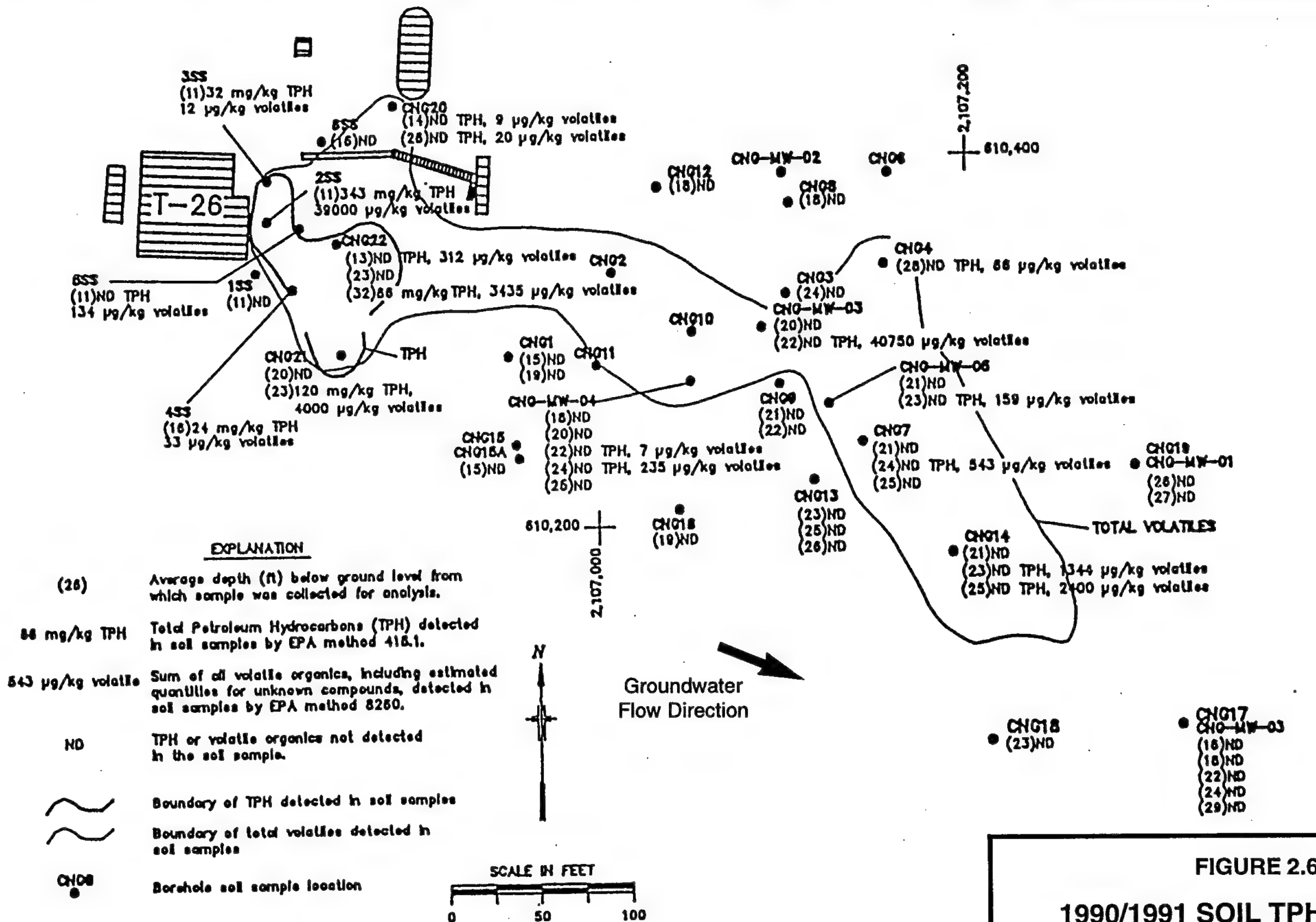
In 1987, ES (1988) installed two additional monitoring wells (I-7-M7 and I-7-M7B) as part of the IRP Phases II and IVA investigations (Figure 2.1). Analytical results from groundwater sampled from these two wells and seven of the Geraghty & Miller wells indicated that benzene, toluene, ethylbenzene, xylenes (BTEX), and naphthalene were present in wells downgradient from Site ST35. Benzene was detected in well GM-39, 250 feet from the source area (Figure 2.1), at concentrations exceeding the maximum contaminant level (MCL) of 5 micrograms per liter (μg/L). Approximately 2 feet of free product was discovered at MW GM37 during the December 1987 investigation (ES, 1988).

2.3.3 1990-1991 Chem-Nuclear Geotech, Inc. Investigations

Chem-Nuclear Geotech, Inc., (1991) performed investigations to further define the extent of soil and groundwater contamination and to characterize the hydrogeology at the OTL during 1990 and 1991. These investigations included a soil gas survey, drilling 26 boreholes, and installing six additional monitoring wells. Based on analytical results for soil samples collected from the boreholes, and subsequent rounds of groundwater sampling, fuel-related contaminants appeared to be confined to a thin interval of alluvium deposited at the erosional bedrock contact. Soil and groundwater sampling results also indicated that the more competent bedrock of the Fountain Formation had not been impacted by contamination from the leaking UST. The distribution of hydrocarbon compounds has been confined within the erosional paleochannel (Chem-Nuclear Geotech, Inc., 1991).

During the Chem-Nuclear Geotech investigations, 50 soil samples were analyzed for total recoverable petroleum hydrocarbons (TRPH), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). TRPH were detected in unsaturated soils at a maximum concentration of 343 milligrams per kilogram (mg/kg) at 11 feet bgs, and were limited to soils in the immediate vicinity of the former UST. The majority of the analytes detected were relatively heavy-molecular-weight, less volatile compounds, including 1-ethyl-4-methylbenzene, 1-methylnaphthalene, 2-methylnaphthalene, naphthlene, n-nonane, 1,2,3,5-tetramethylbenzene, and 1,3,5-trimethylbenzene, which are commonly associated with petroleum hydrocarbons. BTEX compounds detected in soils (and their maximum concentrations) were toluene (18 micrograms per kilogram [μg/kg]), xylenes (2,000 μg/kg), and ethylbenzene (35 μg/kg). Other VOCs detected included acetone (94 μg/kg) and methyl ethyl ketone (MEK) (2,900B μg/kg). The "B" qualifier indicates that the analyte was also detected in the method blank. Benzene was not detected in any of the soil samples. Figure 2.6 summarizes the soil TRPH and VOC results from the Chem-Nuclear Geotech investigation.

Downgradient from the former UST, fuel-related contaminants were detected in soil samples from CNG14, 420 feet from the suspected source area, but were confined to the thin smear zone at approximately 24 feet bgs in largely saturated alluvial material within the paleochannel. During the investigation, free product, measuring 0.3 foot thick, was found on the water table surface, approximately 20 feet bgs, at MW GM37.



Source: Chem-Nuclear Geotech, Inc., 1991.

FIGURE 2.6

1990/1991 SOIL TPH AND VOC ANALYTICAL RESULTS

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Contaminant migration at the site appears to have resulted from product movement along the water table within the bedrock paleochannel.

Results of multiple rounds of groundwater sampling defined a dissolved fuel hydrocarbon plume extending approximately 560 feet downgradient from the former UST location. Dissolved petroleum hydrocarbon constituents detected in alluvial groundwater (and their maximum concentrations) included benzene (110 µg/L), toluene (190 µg/L), ethylbenzene (300 µg/L), and xylenes (780 µg/L). The maximum concentration of total petroleum hydrocarbons (TPH) was 3.9 milligrams per liter (mg/L). Trichloroethene (TCE), trans-1,2-dichloroethene (DCE), vinyl chloride, and naphthlene also were detected in groundwater samples at maximum concentrations of 25 µg/L, 100 µg/L, 16 µg/L, and 3 µg/L, respectively (Chem-Nuclear Geotech, Inc., 1991).

2.3.4 1992 Engineering-Science, Inc. Investigations

Additional investigations were performed at the OTL former UST site in 1992 by ES (ES, 1992a; and, Parsons ES, 1996). The investigation included drilling and sampling 29 boreholes and installing and sampling five groundwater monitoring wells. In addition, components for a 1-year bioventing pilot test, including one air injection vent well (VW) and five soil gas monitoring points (MP1 through MP4 and a background MP), were installed during the 1992 investigations. As part of the 1992 investigations, soil samples were collected and analyzed for VOCs, SVOCs, and total extractable petroleum hydrocarbons (TEPH).

Five VOCs were detected in the 19 subsurface soil samples collected from boreholes in the vicinity of the former UST. Table 2.1 summarizes the analytical results for VOCs in subsurface soil, and Figure 2.7 shows the distribution of detected VOCs. VOCs detected include ethylbenzene, total xylenes, 2-butanone, 2-hexanone, and methylene chloride. Concentrations detected ranged from 6 µg/kg to 1,200 µg/kg for 2-butanone; 1,500 µg/kg for 2-hexanone; 3 µg/kg to 3,000 µg/kg for ethylbenzene; 260 µg /kg to 300 µg/kg for methylene chloride; and 1,000 µg/kg to 6,600 µg/kg for total xylenes. Contamination in the vicinity of the former UST was detected only in samples collected from soil boreholes 6-B2 and 6-B3 (Figure 2.7). The higher concentrations of these analytes were found in samples from 6-B2, and generally increased with depth (Figure 2.7). Methylene chloride, 2-hexanone, and total xylenes were detected only in samples from borehole 6-B2.

Nine soil samples were collected and analyzed for TEPH by Method SW8015, modified for diesel fuel. The TEPH results are presented in Table 2.1 and in Figure 2.8. Miscellaneous hydrocarbons (C7-C1O) were detected at concentrations of 20 mg/kg to 4,880 mg/kg. As shown in Figure 2.8, the most significant TEPH contamination was detected in samples collected in the immediate vicinity of the former UST (soil boreholes 6-B2 and 6-B3); however, some TEPH contamination was also detected approximately 100 feet north of the former UST location (soil boreholes 6-B25, 6-B26, and 6-B27), but is not thought to be the result of the UST oil leak.

TABLE 2.1
SUMMARY OF ORGANIC COMPOUNDS IN SOIL [a/]
OU6 - ORDNANCE TESTING LABORATORY, IRP SITE ST35, OIL LEAK
AIR FORCE PLANT PJKS, COLORADO

				Analyte (units)[b/]										
Sampling Location [c/]	Date Collected	Sample Interval (feet bgs)[d/]		2-Butanone (μg/kg)	2-Hexanone (μg/kg)	Acetone (μg/kg)	Benzene (μg/kg)	Toluene (μg/kg)	Ethyl-benzene (μg/kg)	Total Xylenes (μg/kg)	Methylene Chloride (μg/kg)	Tetra-chloro-ethene (μg/kg)	Chloroform (μg/kg)	TEH (mg/kg)
Oil Leak - Soil														
6-B2 (VW)	05-Aug-92	11.00	11.50	1100	1500	1500 U[e/]	740 U	740 U	560	1100	300	740 U	740 U	929
6-B2 (VW)	05-Aug-92	16.50	17.00	1200	1500	1400 U	740 U	740 U	780	1000	300	740 U	740 U	167
6-B2 (VW)	05-Aug-92	19.00	19.50	980	1500 U	1500 U	690 U	690 U	3000	6600	260	690 U	690 U	4880
6-B3 (MP2)	06-Aug-92	14.00	14.50	6	12 U	28 U	1 U	1 U	5	6 U	14 U	2 U	1 U	76
6-B3 (MP2)	06-Aug-92	16.00	16.50	7	12 U	19 U	1 U	1 U	7	6 U	12 U	2 U	1 U	70
6-B3 (MP2)	06-Aug-92	20.00	20.50	19 U	11 U	16 U	1 U	1 U	3	6 U	15 U	2 U	1 U	223
6-B5 (MP4)	06-Aug-92	20.00	21.50				1 U	1 U	1 U	1 U				
6-B5 (MP4)	06-Aug-92	26.50	27.00				1 U	1 U	1 U	1 U				
6-B6	07-Aug-92	32.00	32.50				1 U	1 U	1 U					
6-B6	07-Aug-92	38.00	38.50				1 U	1 U	1 U	1 U				
6-B7	03-Sep-92	7.00	7.50				1 U	1 U	1 U	1 U				
6-B7	07-Aug-92	14.50	15.00				1 U	1 U	1 U	1 U				
6-B7	07-Aug-92	16.50	17.00				1 U	1 U	1 U	1 U				
6-B8	07-Aug-92	16.50	17.00				1 U	1 U	1 U	1 U				
6-B8	07-Aug-92	22.50	23.00				1 U	1 U	1 U	1 U				
6-B26	03-Sep-92	19.50	20.00				1 U	1 U	1 U	1 U				
6-B26	03-Sep-92	21.00	21.50				1 U	1 U	1 U	1 U				
6-B27	14-Sep-92	16.00	18.00	1 U	11 U	9 U	1 U	1 U	1 U	5 U	5 U	2 U	1 U	20
6-B28	14-Sep-92	18.00	20.00	0.05 R[f/]			0.025 U	0.025 U				0.025 U	0.025 U	20

Source: Parsons ES, 1996

[a/] Volatile organic compounds detected using USEPA Method SW5030/SW8240; total extractable hydrocarbons (TEH) detected using USEPA Method SW8015/SW3550.

[b/] Units are in micrograms per kilogram (μg/kg) for all, except TEH results which are in milligrams per kilogram (mg/kg).

[c/] Initial identifier gives the borehole designation; identifier in paretheses gives bioventing system component; VW=vent well borehole, MP=monitoring point borehole.

[d/] Feet below ground surface.

[e/] U=Analyte not detected in sample. Number shown represents the method detection limit.

[f/] R=Rejected value.

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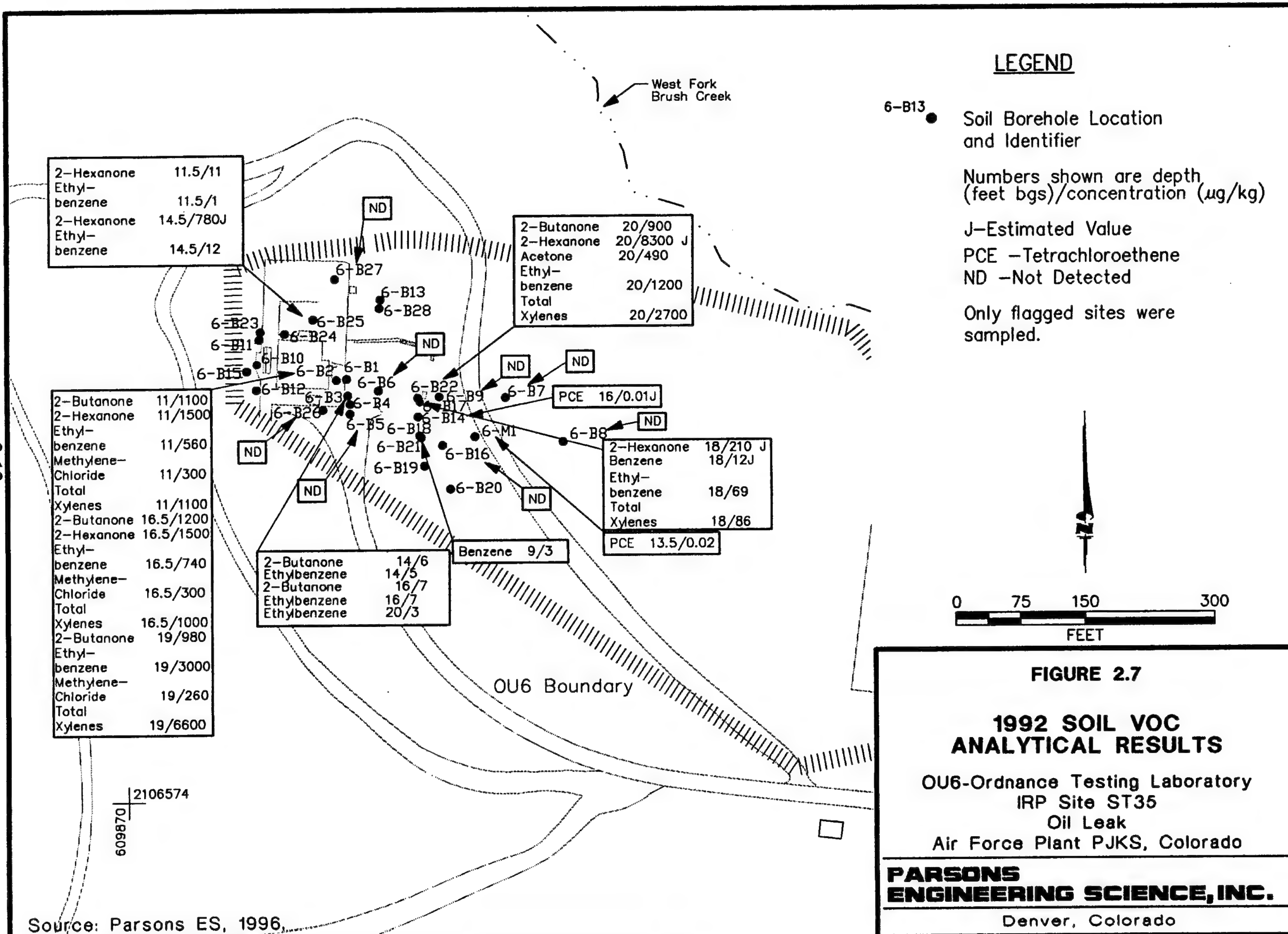

FIGURE 2.7

1992 SOIL VOC ANALYTICAL RESULTS

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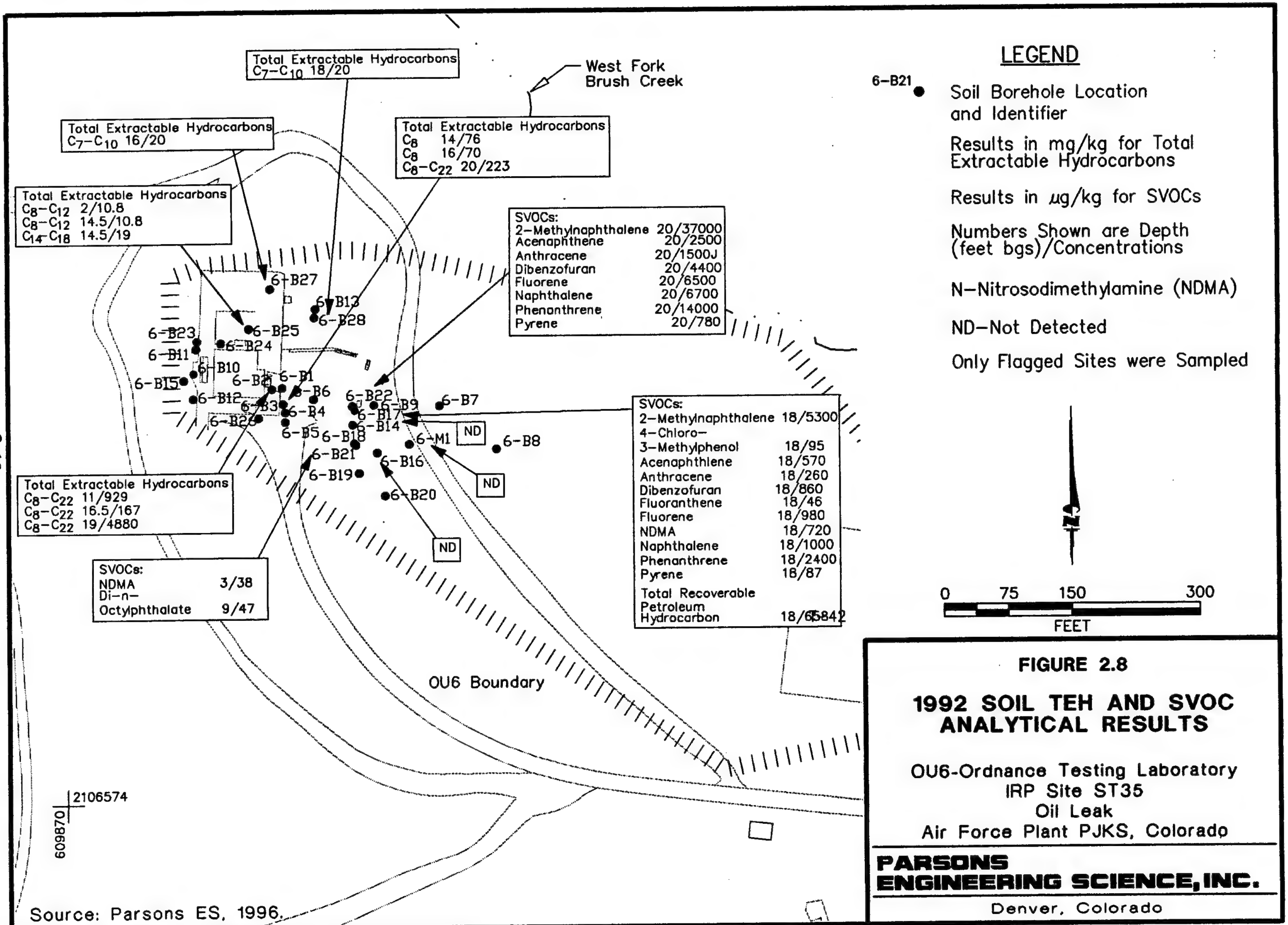

FIGURE 2.8

1992 SOIL TEH AND SVOC ANALYTICAL RESULTS

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

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Subsurface soil samples collected in the immediate vicinity of the former UST were not analyzed for SVOCs, but SVOC analysis by EPA Method SW3520/SW8270 was performed on samples collected east of the former heating oil UST. Figure 2.8 shows the sample locations and SVOC results. Based on information provided in the supplemental RI/FS (1996), the SVOC contamination is attributed to former IRP Site SS52, the cavitette/leach field.

2.3.5 Bioventing Pilot Test

In 1992 and 1993, as part of a nationwide program established by AFCEE, a bioventing system was installed by ES at the OTL UST site to assess the potential of bioventing to remediate the hydrocarbon contamination identified in the vadose zone soils. The details of this installation are described in the bioventing pilot test work plan (ES, 1992). Preliminary pilot test and analytical results are presented in the interim bioventing pilot test letter results report (ES, 1993a), and 1-year test results are summarized in a 5 May 1995 memorandum (AFCEE, 1995). Objectives of the pilot test were to inject air into the subsurface to supply the soil with oxygen, determine the rate at which indigenous microorganisms will degrade fuel when stimulated by oxygen-rich soil gas, and to evaluate the potential for sustaining these rates of biodegradation until fuel contamination was remediated to concentrations below regulatory standards.

During the 1992 ES investigation, one bioventing air injection VW and five vapor monitoring points (MPs), including one background MP were installed in the vicinity of the former UST. Six soil samples were collected from the VW and MP2 boreholes and analyzed for BTEX, TEPH, nutrients, moisture, and grain-size analyses. In addition, one soil gas sample was collected from the VW and analyzed for BTEX and total volatile hydrocarbons (TVH). Soil gas samples could not be collected from the MPs because of high water table conditions which flooded the MP screens. VW and MP locations are shown on Figure 2.9, and initial soil and soil gas analytical results are presented in Table 2.2.

Initial soil gas testing at the VW indicated depleted oxygen concentrations and high TVH concentrations, and suggested that air injection would oxygenate contaminated soils and enhance biodegradation of residual petroleum hydrocarbons by naturally occurring soil microbes. Based on these initial sampling results, a blower system was installed at the site in May 1993 to inject ambient air (oxygen) into the contaminated soil as part of the 1-year pilot test.

After installation, the pilot-scale bioventing system was operated and monitored for a total of approximately 14 months (from May 1993 to July 1994) at which time final respiration tests were conducted and soil gas samples were collected and analyzed. Soil samples were collected and analyzed approximately 4 months later, in November 1994, during a separate site visit. The soil gas and soil results from these samples are presented in Table 2.2. The objective of the soil sampling effort was to determine relative changes in TPH and BTEX concentrations following the period of extended bioventing. Analytical results for soil samples indicate that significant reductions in TPH and BTEX compounds had taken place within the estimated 40- to 50-foot treatment radius of the VW (Table 2.2). Soil gas sampling results were inconclusive

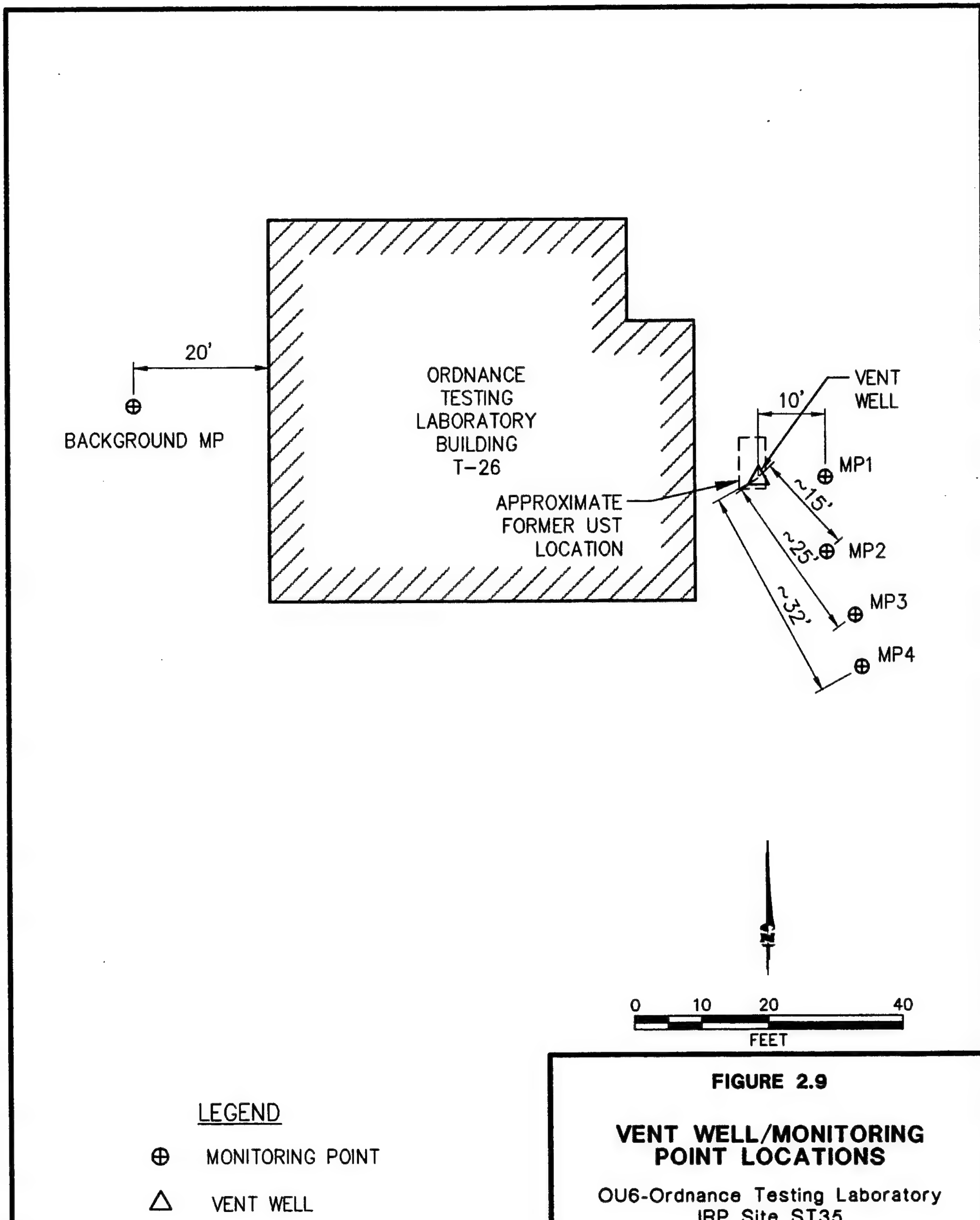

FIGURE 2.9

VENT WELL/MONITORING POINT LOCATIONS

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

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TABLE 2.2
INITIAL AND 14-MONTH SOIL GAS AND SOIL ANALYTICAL RESULTS
OU6 - ORDNANCE TESTING LABORATORY, IRP SITE ST-35, OIL LEAK
AIR FORCE PLANT PJKS, COLORADO

Sample Locations-Depth (feet below ground surface)

Analyte (Units) [a]	VW 5-20	
Soil Gas Hydrocarbons	Initial [b]	14-Month [c]
TVH (ppmv)	2300	11
Benzene (ppmv)	8.2	<0.003
Toluene (ppmv)	8.8	0.004
Ethylbenzene (ppmv)	6.5	0.026
Xylenes (ppmv)	14	0.07

	VW-11		VW-16.5		VW-19		MP2-14		MP2-16		MP2-19	
Soil Hydrocarbons	Initial [d]	14-Month [e]	Initial	14-Month	Initial	14-Month	Initial	14-Month	Initial	14-Month	Initial	14-Month
TPH (mg/kg)	929	105	166	108	4880	17.1	76	370	70	<12.2	223	152
Benzene (mg/kg)	<0.740	<0.05	<0.740	<0.05	<0.690	<0.05	<0.001	<0.05	<0.001	<0.05	<0.001	<0.05
Toluene (mg/kg)	<0.740	<0.05	<0.740	<0.05	<0.690	<0.05	<0.001	<0.05	<0.001	<0.05	<0.001	<0.05
Ethylbenzene (mg/kg)	0.56	<0.05	0.78	<0.05	3	<0.05	0.005	<0.05	0.007	<0.05	0.003	<0.05
Xylenes (mg/kg)	1.1	<0.1	1	<0.1	6.6	<0.1	<0.006	<0.1	<0.006	<0.1	<0.006	<0.1
Moisture (%)	NS [f]	11.1	NS	14.8	8.41	4.9	NS	15.1	NS	18.3	NS	7.2

[a] TVH=total volatile hydrocarbons by USEPA Method TO-3; ppmv = parts per million, volume per volume;
TPH=total petroleum hydrocarbons, including total extractable petroleum hydrocarbons (TEPH) by USEPA Method SW8015/SW3550 (hydrocarbon range C_8-C_{22}), and total recoverable petroleum hydrocarbons (TRPH) by USEPA Method 418.1; mg/kg = milligrams per kilogram.

[b] Initial soil gas samples collected on December 9, 1992. Bioventing system operation did not begin until May 1993.

[c] Final soil gas samples collected on July 10, 1994 following 14 months of bioventing system operation.

[d] Initial soil samples collected on August 5-6, 1992. Initial soil samples analyzed for TEPH.

[e] Final soil samples collected on November 7, 1994. Final soil samples analyzed for TRPH.

[f] NS=not sampled.

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because soil gas could only be measured at the VW due to high groundwater levels in the MPs. Final respiration testing showed TPH in the soil were being degraded at a rate of 890 to 1,900 mg of fuel per kg of soil per year (mg/kg/yr). Table 2.3 summarizes the calculated respiration and fuel biodegradation rates for various times during pilot testing. Based on soil analytical results, TPH concentrations were reduced more than 80 percent during the 14-month extended bioventing test, from an average concentration of 1,060 mg/kg to 127 mg/kg. Total BTEX were reduced from an average concentration of approximately 2,180 μg/kg to below method detection limits during the 14-month period of bioventing system operation.

2.3.6 Results Summary

Based on the results of the previous investigations, the former heating oil UST has been identified as the probable source of most of the petroleum hydrocarbon contamination within OU6. Soil sample results from the 1985 through 1992 investigations indicated the highest concentrations of TPH and other fuel-related hydrocarbons occurred in vadose zone soils in the immediate vicinity of the former UST. Based on this information, a bioventing pilot-scale system was installed at the location of the former UST, and after 14 months of system operation, significant reductions in TPH and BTEX contamination in site soils was evident. Figure 2.10 shows the extent of TPH and VOC soil contamination at the former OTL UST, and the areas suspected as exceeding 250 mg/kg TPH in soils in 1992, and following bioventing treatment in 1994. While BTEX contamination in site soils has never appeared as exceeding 50 mg/kg; results of soil sampling following the bioventing pilot test indicate nondetect levels in soils in the immediate vicinity of the former UST.

It should be noted that benzene, which is not a significant constituent in heating oil, has been detected at several locations within OU6. Based on historical site information, it is believed that other fuels may have been released during former activities at the OTL, such as during acoustics testing at a former jet engine test stand located near the northeastern corner of the OTL building. As previously mentioned, TEPH also were detected at low concentrations (from 11 to 20 mg/kg) in soil samples collected from three boreholes (6-B25, 6-B27 and 6-B28) located north of the former heating oil UST (Parsons ES, 1996).

While existing data show some fuel-related contamination at other areas of the OTL, results of soil sampling in the vicinity of the former UST indicate that BTEX concentrations have been reduced to levels below CDOLE Oil Inspection Section (1995) action levels, and TPH concentrations were approaching, or had been reduced below, action levels. Based on this evidence, AFCEE recommended that the bioventing pilot-scale system continue to operate while planning for confirmation sampling.

TABLE 2.3
RESPIRATION AND FUEL BIODEGRADATION RATES
OU-6 ORDNANCE TESTING LABORATORY, IRP SITE ST-35, OIL LEAK
AIR FORCE PLANT PJKS, COLORADO

Location-Depth (feet below ground surface)	Initial (Dec. 1992) [a/]			6-Month (Dec. 1993) [c/]			14-Month (Jul-Aug 1994)		
	K_o (% O_2/min)	Degradation Rate (mg/kg/year)[b/]	Soil Temperature (°C)	K_o (% O_2/min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)	K_o (% O_2/min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)
VW	0.0087	2,200	NS [d/]	0.0022	490 [e/]	NS [d/]	0.0042	890 [f/]	NS [d/]
MP1-24	NS [g/]	NC [h/]	15.2	NS [g/]	NC	NS [d/]	0.0068	1,900 [i/]	NS [d/]
MP2-21.7	NS [g/]	NC	15.4	NS [g/]	NC	NS [d/]	NS [g/]	NC	NS [d/]
MP3-22	NS [g/]	NC	15.5	0.0036	1,000 [i/]	NS [d/]	NS [g/]	NC	NS [d/]
MP4-26.3	NS [g/]	NC	15.3	NS [g/]	NC	NS [d/]	NS [g/]	NC	NS [d/]

a/ Initial respiration testing performed in December 1992, but system operation did not begin until May 1993.
b/ Milligrams of hydrocarbons per kilogram of soil per year.
c/ Assumes moisture content of the soil is average of initial and final moistures.
d/ NS = Not sampled.
e/ Average of initial and 14-month moisture values at 11', 16.5', and 19' depths used in calculating degradation rate for VW.
f/ Average of November 1994 moisture values at 11', 16.5', and 19' depths used in calculating degradation rate for VW.
g/ Oxygen utilization (respiration rates) could not be determined at these points because the screened interval was under water during testing.
h/ NC = Not calculated.
i/ Moisture result from MP2-19 in November 1994 used in calculating degradation rate for MP1 and MP3.

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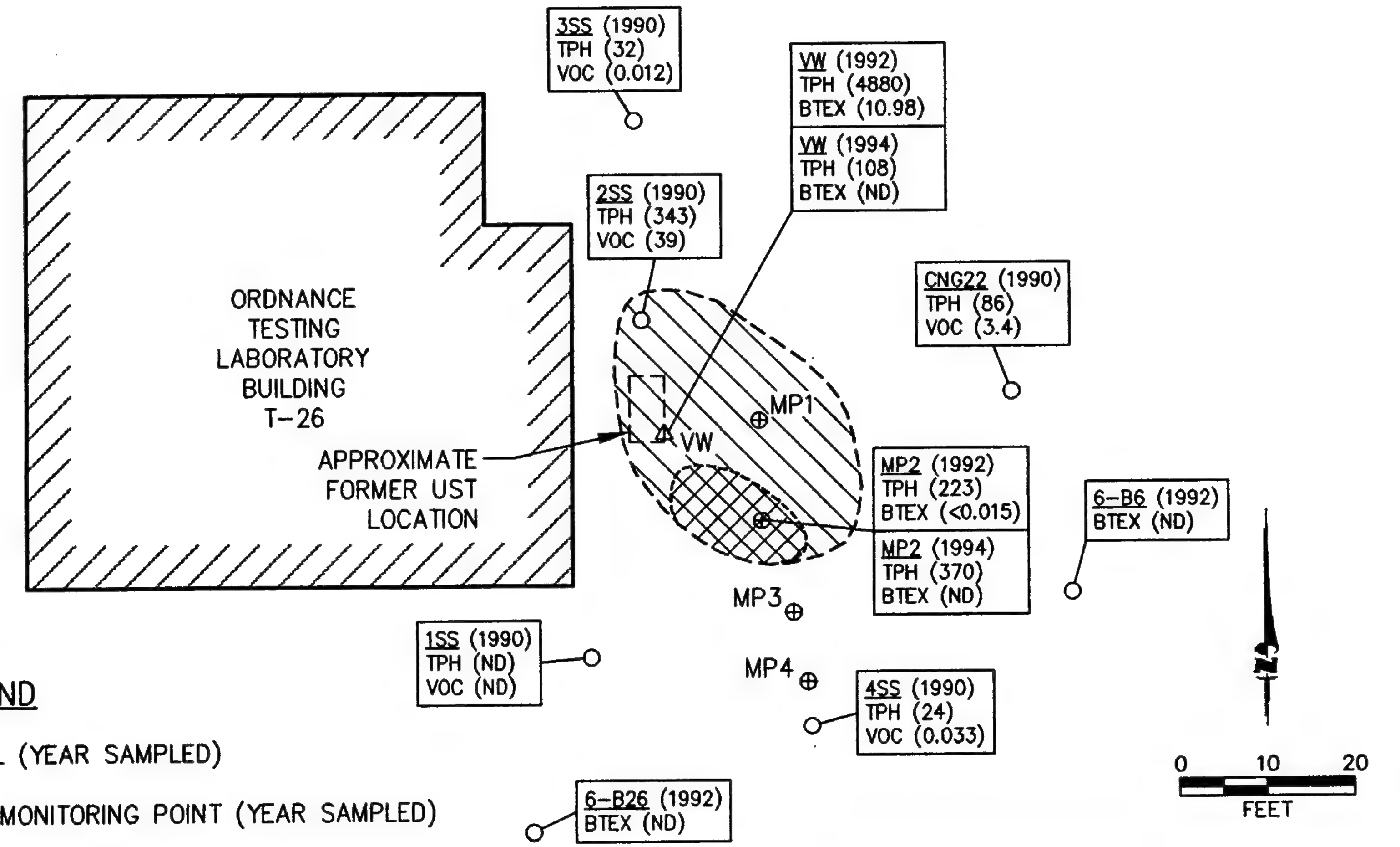

LEGEND

△ VENT WELL (YEAR SAMPLED)

⊕ SOIL GAS MONITORING POINT (YEAR SAMPLED)

○ SOIL BOREHOLE (YEAR SAMPLED)
TPH(32)–TOTAL PETROLEUM HYDROCARBON (RESULT IN mg/kg)
VOC(39)–VOLATILE ORGANIC COMPOUND (RESULT IN mg/kg)
BTEX(10.98)–BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES (RESULT IN mg/kg)

ND COMPOUNDS NOT DETECTED

1992 SUSPECTED AREA EXCEEDING 250 mg/kg TPH

1994 SUSPECTED AREA EXCEEDING 250 mg/kg TPH

FIGURE 2.10

SUMMARY OF TPH AND VOC SOIL ANALYTICAL RESULTS

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

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SECTION 3

SITE CLEANUP REQUIREMENTS

Site-specific closure requirements for the OTL former heating oil UST site have not been established because this is an interim status site under the IRP. The Colorado Department of Public Health and Environment (CDPHE) and the United States Environmental Protection Agency (USEPA) are currently negotiating an interagency agreement with the Air Force that will determine how the site will be regulated. As a result of the ongoing negotiations, confirmation soil sampling at Site ST35 represents a voluntary action.

OU6 includes two current and one former IRP sites that are potential source areas for soil and groundwater contamination. The sites include the former heating oil UST (the focus of this work plan), the open detonation/open burning pit, and a cavitette/leach field (the cavitette/leach field is no longer an IRP site). Previous investigations have identified the leaking UST as the probable source for petroleum hydrocarbon contamination. The highest concentrations of TPH and other fuel-related hydrocarbons have been detected in soils in the immediate vicinity of the former UST; however, bioventing in the former location of the UST has significantly reduced fuel-related hydrocarbon contamination in site soils. This section and Section 4 address closure sampling at the former UST study area within OU6.

3.1 SITE CHARACTERIZATION REQUIREMENTS

Because the interagency agreement among the Air Force, USEPA, and CDPHE has not been finalized, the sampling plan presented in this report is based upon generally accepted sampling protocols for fuel UST site closure soil sampling (CDOLE, 1995).

The objective of the confirmatory soil sampling is to support an NFRAP recommendation for the soils contaminated by heating oil in the immediate vicinity of the former UST, pursuant to closure of Site ST35 in OU6. This sampling plan targets only unsaturated soils above the groundwater table; groundwater contamination, whether from fuel hydrocarbons or other contaminant sources, is to be addressed under ongoing studies for OU5, Brush Creek Groundwater.

3.2 STATE SOIL CLEANUP STANDARDS

Although site-specific soil cleanup standards have not been established for Site ST35 pending negotiation of the interagency agreement, state storage tank cleanup standards are adopted as cleanup goals for fuel-contaminated soils. Storage tank cleanup standards are presented in the Storage Tank Facility Owner/Operator Guidance

Document (CDOLE, 1995). Storage tank sites formerly under the jurisdiction of the CDPHE are now under the jurisdiction of the CDOLE, Oil Inspection Section.

Cleanup standards are dependent on the beneficial use classification of the aquifer impacted or potentially impacted by soil petroleum hydrocarbon contamination. Based on known site conditions, site soils overlying OU5 groundwater would likely be classified as remedial action category level II (RAC II), an intermediate category based on potential future use of the aquifer as a potable water source. Definitions of the three RACs are summarized below.

RAC I includes petroleum contamination of:

- groundwater currently being used as a public and/or private drinking water supply;
- groundwater withdrawn by a public water supply system that is used, or is intended to be used, as drinking water;
- groundwater used incidentally or intermittently for public drinking water;
- groundwater temporarily not being used, but has been used in the past for public drinking water;
- groundwater having the potential for being used as a public drinking water supply; or,
- groundwater within 500 feet or within the zone of influence of a private drinking water-supply well.

RAC II includes petroleum contamination of:

- groundwater that has the potential for being used as a private drinking water supply; or
- groundwater not included in the RAC I designation such as petroleum contamination of groundwater not more than 500 feet from, or outside the zone of influence of, a private water well.

RAC III includes, but is not limited to, petroleum contamination of:

- groundwater not being used, and with little or no potential for being used, as a public or private drinking water supply.

Assuming a RAC II classification for OU6, contaminated soils that have impacted or have the potential to impact RAC II groundwater should be remediated to concentrations of less than or equal to 50 mg/kg total BTEX and 250 mg/kg TPH. These levels may be determined by the state to be more or less stringent based upon risk assessment and FSs (CDOLE, 1995).

SECTION 4

SITE CONFIRMATION SOIL SAMPLING AND ANALYSIS PLAN

The following SAP describes the borehole locations, sampling depths, soil sampling procedures, and analytical methods proposed to collect sufficient data to verify remediation of Site ST35 soils to CDOLE RAC II cleanup levels, and to support site closure. Sampling and laboratory testing will follow the procedures recommended in the Storage Tank Facility Owner/Operator Guidance Document (CDOLE, 1995).

As described in Section 2, Site ST35 was characterized during the 1985 through 1992 investigations. In addition, analytical results from limited soil sampling conducted following approximately 14 months of bioventing indicated substantial reductions in soil BTEX and TPH concentrations attributed to bioventing remediation. Beneath the former UST site, soil petroleum hydrocarbon contamination of the vadose zone was limited to within approximately 30 feet of the former UST and to depths between approximately 11 and 30 feet bgs. Because soil samples were collected from only two locations (the VW and MP2, designated 6-B2 and 6-B3, respectively, during the 1992 ES investigation) following bioventing treatment, Parsons ES proposes to drill and sample seven additional boreholes in the vicinity of the former UST to more completely characterize the petroleum hydrocarbon contamination remaining in soils.

4.1 DRILLING, SAMPLING, AND EQUIPMENT DECONTAMINATION

Seven boreholes will be drilled and sampled in the vicinity of the former UST at the approximate locations shown on Figure 4.1. Up to three additional boreholes may be drilled and sampled if field screening results from the first seven boreholes indicate significant contamination extending beyond the proposed sampling area. The locations of the additional boreholes would be determined in the field, and therefore are not shown on Figure 4.1. Boreholes will be advanced using a drill rig equipped with 3.25-inch inside-diameter (ID) hollow-stem augers. Soil cuttings generated during drilling will be screened with a photoionization detector (PID) and a total volatile hydrocarbon analyzer (TVHA). Those cuttings that exhibit staining, odor, or headspace readings above background levels will be placed in US Department of Transportation (DOT)-approved 55-gallon drums. The drums will be labeled with the site name, drilling date, borehole number, and depth intervals. To minimize cuttings disposal costs, cuttings showing no field evidence of contamination will be returned to the borehole from which they were generated.

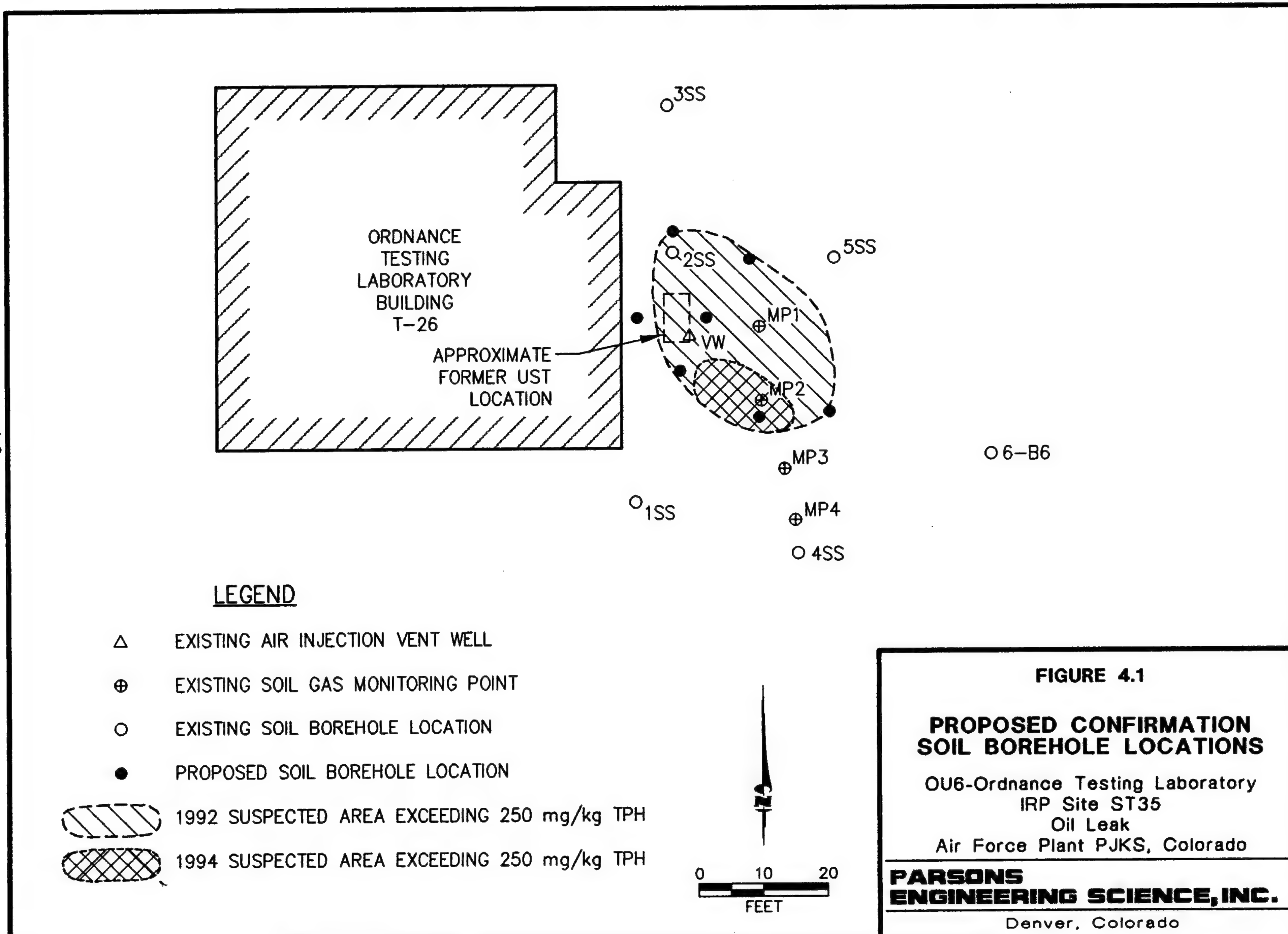

FIGURE 4.1

PROPOSED CONFIRMATION SOIL BOREHOLE LOCATIONS

OU6-Ordnance Testing Laboratory
IRP Site ST35
Oil Leak
Air Force Plant PJKS, Colorado

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Augers and other downhole equipment will be cleaned before use and between boreholes to prevent cross-contamination. Cleaning will be accomplished using a high-pressure hot-water wash, followed by a potable water rinse. Decontamination fluids will be collected and contained in labeled 55-gallon drums.

Boreholes will be drilled to 5 feet below the groundwater table or to the top of the competent (unweathered) bedrock, whichever is encountered first. The estimated borehole depth is 25 feet bgs, and the estimated maximum drilling footage for these seven boreholes is 175 feet. Boreholes will be logged by a Parsons ES geologist. Soil types will be classified according to the Unified Soil Classification System (USCS) and described in accordance with the standard Parsons ES soil description format. Soil samples will be collected at 5-foot intervals from the base of the former UST excavation, assumed to be at a depth of 6 feet bgs, to 5 feet below the groundwater table (i.e., sample collection at 5 to 7 feet bgs, 10 to 12 feet bgs, 15 to 17 feet bgs, etc.) or until competent bedrock is encountered, whichever occurs first. All soil samples will be visually examined and field analyzed using a PID and a TVHA. Based on field observations, the two samples with the greatest apparent contamination from each boring will be selected and submitted for laboratory analysis of TEPH and BTEX.

Soil samples will be collected in a standard split-barrel sampler that will be lowered through the hollow stem of the augers and driven approximately 1.5 foot (or to refusal, if shallower) into undisturbed soil, ahead of the augers. Between sampling events, the split-barrel sampler will be cleaned with Alconox® detergent, followed by successive potable and distilled water rinses.

The split-barrel sampler will be fitted with three precleaned, 6-inch-long, thin-walled, brass sleeves. Before samples are collected, sample sleeves will be cleaned using the same procedure as that described for the sampler. After collection of a sample, the sampler will be retrieved, split apart, and the sleeves will be removed. In preparation for laboratory submittal, the ends of the lowest (i.e., deepest) brass sleeve will be covered with Teflon® sheets and plastic end caps.

The upper (i.e., shallower) sample sleeves will be used for geologic logging and will be screened in the field for organic vapors using a PID and a TVHA. The data obtained from the logging and screening will be recorded on the borehole logs. Based upon field determination, two sleeves per boring will be selected for laboratory analysis, and labeled with the site name and borehole number, sample depth, date of collection, project name, and other pertinent data. These sleeves will be sealed in plastic bags and immediately placed in an insulated cooler containing ice. The soil samples will be maintained in a chilled condition until delivered to the analytical laboratory. Chain-of-custody records will be prepared in the field and will accompany the samples to the analytical laboratory.

Boreholes will be abandoned using cement/bentonite grout following drilling and sampling. The grout mixture will contain a maximum of 5 percent bentonite.

4.2 SOIL SAMPLE ANALYSIS

Proposed soil sample analytical methods and detection limits are presented in Table 4.1. All samples will be analyzed by a State of Colorado-certified and AFCEE-approved laboratory. Parsons ES proposes to analyze samples from the OTL former UST site for TEPH by USEPA Method SW8015, modified for diesel-range organics, and by USEPA Method SW8240B for BTEX and chlorinated VOCs. Quality control (QC) samples also will be collected and analyzed to assess field and laboratory methods. QC samples to be analyzed include a minimum of one trip blank, one matrix spike/matrix spike duplicate, and one rinseate blank.

TABLE 4.1
PROPOSED SOIL SAMPLE ANALYTICAL METHODS, PRACTICAL QUANTITATION LIMITS, AND NUMBER OF SAMPLES
OU6 - ORDNANCE TESTING LABORATORY, IRP SITE ST35, OIL LEAK
AIR FORCE PLANT PJKS, COLORADO

Analyte	Number of Samples [a/]	PQL (mg/kg) [b/]
USEPA Method SW8015		
Modified for Diesel-Range Organics [c/]	14	10.0
USEPA Method SW8240B		
Acetone	14	0.1
Benzene	14	0.005
Bromodichloromethane	14	0.005
Bromoform	14	0.005
Bromomethane	14	0.01
2-Butanone	14	0.05
Carbon disulfide	14	0.005
Carbon tetrachloride	14	0.005
Chlorobenzene	14	0.005
Chlorodibromomethane	14	0.005
Chloroethane	14	0.01
2-Chloroethyl vinyl ether	14	0.01
Chloroform	14	0.005
Chloromethane	14	0.01
1,1-Dichloroethane	14	0.005
1,2-Dichloroethane	14	0.005
1,1-Dichloroethene	14	0.005
cis-1,2-Dichloroethene	14	0.005
trans-1,2-Dichloroethene	14	0.005
1,2-Dichloropropane	14	0.005
cis-1,3-Dichloropropene	14	0.005
trans-1,3-Dichloropropene	14	0.005
Ethylbenzene	14	0.005
2-Hexanone	14	0.05
Methylene chloride	14	0.005
4-methyl-2-Pentanone	14	0.05
Styrene	14	0.005
1,1,2,2,-Tetrachloroethane	14	0.005
Tetrachlorethene	14	0.005
Toluene	14	0.005
1,1,1-Trichloroethane	14	0.005
1,1,2-Trichloroethane	14	0.005
Trichloroethene	14	0.005
Vinyl acetate	14	0.05
Vinyl chloride	14	0.002
m,p-Xylene	14	0.005
o-Xylene	14	0.005

[a/] Excludes QC samples. If optional boreholes are required, two additional samples per optional borehole also will be collected and analyzed.

[b/] PQL = Inchcape Testing Services Laboratory, Richardson, Texas, practical quantitation limit;
mg/kg = milligrams per kilogram.

[c/] Results will be reported for the C11-C28 range (diesel) of carbon chains using the simulated distillation method.

SECTION 5

SITE CONFIRMATION SAMPLING REPORT FORMAT

Following receipt of the laboratory analytical results, a draft confirmation soil sampling report will be prepared and submitted to Headquarters ASC/EMR and AFCEE.

The report will contain the following information for the former UST site:

- Plot plans showing final borehole locations;
- Summary of field activities;
- Assessment of analytical results in comparison to CDOLE (1995) RAC II soil cleanup criteria for TPH and BTEX;
- Laboratory analytical reports and chain-of-custody forms;
- Borehole logs; and
- Conclusions and recommendations for site closure or additional cleanup action.

Comments received from ASC/EMR and AFCEE will be incorporated into a draft final report to be distributed to AFCEE, ASC/EMR, EPA, CDPHE, and CDOLE.

SECTION 6

WASTE MANAGEMENT PLAN

This waste management plan applies to the activities that will be performed for confirmation soil sampling at AFP PJKS. The plan describes the types of investigation derived waste (IDW) that will be generated and management of the generated waste, including inventory, tracking, reporting, and disposal.

6.1 WASTE TYPES

The waste materials that may be generated during the confirmation sampling and managed under this plan include both solid materials and waste waters. The solid materials include cuttings produced from drilling soil boreholes, disposable sampling equipment, and personal protective equipment (PPE). The waste waters that may be produced include rinseate water from decontamination of drilling and sampling equipment. The following paragraphs describe the management procedure for these materials.

6.2 WASTE MANAGEMENT

6.2.1 Drill Cuttings

Soil drill cuttings, as an environmental media, are not considered as solid waste. They can, however, contain listed hazardous wastes or enough hazardous constituents that they may exhibit hazardous waste characteristics. The general approach is to manage soil cuttings in a conservative manner by containerizing them, unless there is information available to predetermine that the soil is clean. The following paragraphs describe the management of drill cuttings from soil boreholes.

The soil borehole sampling locations were selected to confirm adequate remediation of soils previously identified as being contaminated with fuel related hydrocarbons. As such, drill cuttings from site boreholes will be containerized into 55-gallon drums (DOT 17-H) as the standard procedure. Soil borehole drilling is designed to terminate 5 feet below the groundwater table or at the top of competent bedrock, whichever occurs first. The typical borehole total depth is expected to be approximately 25 feet bgs. Soil cuttings will be field screened while drilling using a PID. Samples for laboratory analysis will be selected based on field screening results. Containerized soil cuttings from boreholes will be left at the drill site until the laboratory analytical data is available. If the soil does not contain any hazardous constituents at concentrations exceeding risk-based soil criteria for AFP PJKS, then the soil cuttings will be spread on

the ground surface near the boreholes. AFP PJKS risk-based soil criteria for human and ecological receptors are summarized on Table 6.1.

If the analytical results indicate contaminant levels exceed the risk-based soil criteria, the containerized drill cuttings will be properly labeled, transported to a waste storage area, and managed appropriately. If the risk-based soil criteria are exceeded, it is expected that containerized soil from the site will be classified as Petroleum Contaminated Soil as defined in *State of Colorado Department of Public Health and Environment, Information Regarding the Management of Petroleum Contaminated Soil* (CDPHE, 1995). Any containerized soil exceeding the risk-based criteria and classified as petroleum contaminated soil will be disposed of at a landfill licensed to accept these wastes. Based on analytical results, drill cuttings which either contain a listed hazardous waste or sufficient hazardous constituents that they exhibit hazardous waste characteristics will be disposed of at a licensed treatment, storage, disposal, and recycling (TSDR) facility.

6.2.2 Personal Protective and Disposable Sampling Equipment

Confirmation soil sampling equipment and clothing which becomes contaminated, and will not be reused, will be containerized for offsite disposal. Examples of PPE include latex gloves and Tyvek® suits. Sample bottles and plastic sheeting are examples of disposable sampling equipment. These materials represent solid waste and will be considered hazardous waste if they are suspected to be contaminated with listed wastes. These materials will be containerized and managed in accordance with State of Colorado policies for IDW (CDPHE).

6.2.3 Decontamination/Equipment Rinseate Water

Rinseate water generated at the drill site will be collected and transported to a centralized decontamination facility at AFP PJKS where drill rigs and large equipment are decontaminated. Large equipment will be decontaminated at the centralized facility on asphalt pads which are enclosed by berms. Water generated during decontamination drains from the asphalt pads into a concrete sump. After each decontamination event, the rinseate water will be pumped from the sump into temporary storage tanks, also situated on a pad which drains into the sump. When a storage tank becomes full, a sample is collected from the tank and taken to the Lockheed Martin (LM) laboratory for treatability analysis. If the water can be treated at the LM water treatment facility, LM will dispatch a vacuum truck to pump out the temporary tank contents and transport the waste water directly to batch tanks at the LM water treatment facility. If the water cannot be treated at the LM facility, the waste water will be managed in accordance with State of Colorado hazardous waste regulations. This rinseate water will enter the wastewater treatment system within 90 days of removal from the sump.

6.3 WASTE INVENTORY, TRACKING, AND REPORTING

All solid materials generated from confirmation soil sampling activities and classified as containing hazardous or petroleum contaminated waste, will be managed using "cradle-to-grave" tracking procedures. Formal documentation of the waste stream will commence when a container is placed into service. A container is placed into service

TABLE 6.1
SOIL CRITERIA FOR HUMAN AND ECOLOGICAL RECEPTORS
OU6 - ORDNANCE TESTING LABORATORY, IRP SITE ST35, OIL LEAK
AIR FORCE PLANT PJKS, COLORADO

Analyte	Human Receptors Carcinogenic [a] (mg/kg)	Human Receptors Non-Carcinogenic [b] (mg/kg)	Ecological Receptors [c] (mg/kg)
USEPA Method SW8240B			
Acetone	—	27,000	—
Benzene	22.07	—	525-20,000
Bromodichloromethane	4.92	5,400	—
Bromoform	81.01	5,400	—
Bromomethane	—	378	—
2-Butanone	—	13,500	—
Carbon disulfide	—	27,000	—
Carbon tetrachloride	4.92	189	—
Chlorobenzene	—	5,400	—
Chlorodibromomethane	7.62	5,400	—
Chloroethane	0.34	—	—
2-Chloroethyl vinyl ether	—	—	—
Chloroform	104.92	2,700	—
Chloromethane	49.23	—	—
1,1-Dichloroethane	—	27,000	—
1,2-Dichloroethane	7.03	—	—
1,1-Dichloroethene	1.07	2,430	—
cis-1,2-Dichloroethene	—	2,700	—
trans-1,2-Dichloroethene	—	5,400	—
1,2-Dichloropropane	—	—	—
cis-1,3-Dichloropropene	3.56	81	—
trans-1,3-Dichloropropene	3.56	81	—
Ethylbenzene	—	27,000	190,000
2-Hexanone	—	—	—
Methylene chloride	85.33	16,200	—
4-methyl-2-Pentanone	—	—	—
Styrene	—	54,000	—
1,1,2,2,-Tetrachloroethane	3.20	—	—
Tetrachlorethene	—	2,700	—
Toluene	—	54,000	—
1,1,1-Trichloroethane	—	24,300	—
1,1,2-Trichloroethane	11.23	1,080	—
Trichloroethene	—	—	—
Vinyl acetate	—	—	—
Vinyl chloride	0.34	—	>200
m,p-Xylene	—	540,000	—
o-Xylene	—	540,000	—

Source: Parsons ES, 1993b

[a] Preliminary Remediation Goals (PRGs) for residential ingestion of soils calculated from carcinogenic slope factors.

[b] PRGs for residential ingestion of soils calculated from noncarcinogenic reference doses.

[c] Literature phytotoxicity guidelines for soil.

when it is assigned an accumulation start date, a unique identification number, and a waste tracking inventory sheet. The waste tracking inventory sheet is initiated when a container is placed into service. Entries are made on the waste tracking inventory sheet in the information section as waste is added to the container, or if the container is moved to a new location. This information allows the identification of all containers in service and the number of days left on each container's 90-day clock. The inventory sheet is completed and the unique identification number is closed when the waste is treated, consolidated, or shipped to a commercial TSDR, or other licensed waste disposal facility, depending on the waste classification.

Establishment of a waste stream profile sheet requires preparation of a commercial TSDR facility, or other licensed waste disposal facility, profile information sheet. The characterization information that must be entered on the form is required by the disposal facility to profile and except the waste. When a shipment is made, a Uniform Hazardous Waste Manifest or appropriate State manifest is prepared and accompanies each shipment to the disposal facility. This record includes the generator copy of the manifest which is replaced by the original copy upon return, including the commercial disposal facility representative's signature. Manifest information is added to the waste tracking inventory sheet.

Containers holding waste water that are taken to the 90-day accumulation area are inspected weekly to ensure that they enter the waste water treatment plan system within 90 days. Wastewater that cannot be treated at the LM facility will be inventoried, profiled, and manifested according to the same procedures outlined above.

SECTION 7

PLANT SUPPORT REQUIREMENTS

The following AFP PJKS support is needed prior to the arrival of the drillers and the Parsons ES team:

- Assistance in obtaining drilling and digging permits.
- Arrangement of site and plant access for Parsons ES and the drilling subcontractor.
- Provision of an acceptable area for equipment decontamination.
- Provision of a potable water supply for decontamination activities.
- Assistance in handling/treating decontamination rinseate water.

SECTION 8

PROJECT SCHEDULE

The following schedule is contingent upon approval of this confirmation sampling and analysis plan and completion of AFP PJKS support requirements.

Event	Date
Submit Draft Confirmation SAP to AFCEE and ASC/EMR	28 June 1996
Receipt of AFCEE and ASC/EMR Comments	26 July 1996
Submit Draft Final SAP to AFCEE and ASC/EMR	20 September 1996
Begin Confirmation Soil Sampling	21 October 1996
Submit Draft Confirmation Soil Sampling Report to AFCEE and ASC/EMR	20 December 1996
Receipt of AFCEE and ASC/EMR Comments	10 January 1997
Submit Draft Final Confirmation Soil Sampling Report to AFCEE, ASC/EMR, EPA, CDPHE, and CDOLE	24 January 1997

SECTION 9

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SECTION 10

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